BICYCLE SPROCKET FOR USE WITH A MULTI-GEAR REAR CASSETTE

TECHNICAL FIELD

The present invention relates to a bicycle sprocket and, more specifically, to a rear bicycle sprocket for use with a multi-gear rear cassette and to a multi-gear rear cassette and a bicycle having a multi-gear rear cassette including the rear sprocket.

BACKGROUND

In a conventional bicycle multi-gear rear cassette, a plurality of sprockets of variable diameter are axially distributed along and co-axially mounted to a freehub body. Each sprocket has a plurality of teeth about its perimeter for engaging a bicycle chain. For example, a mountain bicycle rear cassette with ten sprockets, S_1-S_{10}, could have sprockets with the following teeth (T) profiles: 11T, 13T, 15T, 17T, 19T, 21T, 24T, 28T, 32T, and 36T (i.e., 11T to 36T). When a shift control device is actuated by a bicyclist, a rear derailleur transfers the chain from the teeth of one sprocket to another.

To reduce the weight of the cassette, a sprocket carrier has been used to support a plurality of sprockets. A relatively low density metal such as aluminum is typically used for the carrier, while various types of steel materials provide the sprockets with adequate strength. The carrier comprises a plurality of radially extending mounting arms. Each mounting arm includes a sprocket mounting portion. Fasteners, such as bolts, mating threads, coupling projections, rivets, and the like, are used to fasten the sprockets to the sprocket mounting portion of the carrier. These mechanical connections not only require additional materials making the sprocket assembly heavier, but also weaken the mating parts and provide possible fatigue and fracture failure points on both the sprockets and carrier. Further, such mechanical connections introduce additional unwanted flexibility as they twist and deform under loading.

It may be desirable to increase the number of sprockets available in a bicycle multi-gear rear cassette to provide the bicyclist with a greater choice of gears. In relatively recent years, the number of sprockets in a typical mountain bicycle multi-gear rear cassette has increased from nine to ten sprockets. Even more recently, the number of sprockets has increased from ten to eleven. By increasing the number of sprockets, the bicyclist may be able to increase the range of the multi-gear rear cassette (i.e., the ratio derived from dividing the teeth profile of the sprocket having the largest diameter by the teeth profile of the sprocket having the smallest diameter) thereby providing the bicyclist with a greater range of gears to choose from. Thus, the range of a typical mountain bicycle multi-gear rear cassette having ten sprockets ranging from 11T to 36T has a range of 327%, which is greater than the range of a typical mountain bicycle multi-gear cassette having nine sprockets ranging from 11T to 34T (i.e., a 309% range). The range of a typical mountain bicycle multi-gear cassette having eleven sprockets ranging from 10T to 42T is greater still (i.e., 420%).

While a drivetrain having an eleven sprocket rear cassette is advantageous to bicyclists due to the enhanced range, an eleven sprocket rear cassette is incompatible with drivetrains designed for use with nine or ten sprocket rear cassettes. For a bicyclist to install an eleven sprocket rear cassette on a bicycle having a drivetrain using a nine or ten sprocket cassette, the bicyclist must purchase and install a new bicycle chain, rear derailleur, shift control device, and/or front chain rings. This can be prohibitively expensive.

There is a general desire to increase the range of gears available to a bicyclist without the bicyclist having to make substantial changes to the drivetrain and/or considerably increasing the weight of the bicycle.

The foregoing examples of the related art and limitations related thereto are intended to be illustrative and not exclusive. Other limitations of the related art will become apparent to those of skill in the art upon a reading of the specification and a study of the drawings.

SUMMARY

The following embodiments and aspects thereof are described and illustrated in conjunction with systems, tools, and methods which are meant to be exemplary and illustrative, not limiting in scope. In various embodiments, one or more of the above-described problems have been reduced or eliminated, while other embodiments are directed to other improvements.

One aspect of the present invention provides a bicycle sprocket for use with a multi-gear rear cassette that improves the gear range of the cassette and can be used with most conventional drivetrains designed for use with a ten sprocket rear cassette.

Another object of the present invention is to provide a bicycle multi-gear rear cassette having an improved gear range that can be installed for use with most conventional drivetrains designed for use with a ten sprocket rear cassette.

One aspect of the present invention provides a bicycle sprocket for use with a multi-gear rear cassette. The sprocket includes a chain engaging portion and a mounting portion, both having a generally annular shape about a central axis. A radially outward edge of the chain engaging portion comprises a plurality of circumferentially spaced and radially outwardly extending teeth for mechanical engagement with a bicycle chain. A radially inward edge of the mounting portion defines an aperture shaped to receive therein a freehub body. A radially outward edge of the mounting portion is radially spaced apart from a radially inward edge of the chain engaging portion. A plurality of spaced support arms, integrally formed with the chain engaging portion and with the mounting portion, extends radially outwardly from the radially outward edge of the mounting portion to the radially inward edge of the chain engaging portion. The sprocket further includes a plurality of space maintaining protrusions, each space maintaining protrusion integrally formed with and extending axially forwardly from an axially forward surface of a corresponding support arm.

In some embodiments, an axially forward surface of the mounting portion and an axially forward surface of each space maintaining protrusion extend further axially forwardly than an axially forward surface of the chain engaging portion.

In some embodiments, the axially forward surface of the mounting portion extends further axially forwardly than the axially forward surface of each space maintaining protrusion.

In some embodiments, the support arms may be circumferentially spaced apart from one another about the radially outward edge of the mounting portion and/or about the radially inward edge of the chain engaging portion.

In some embodiments, the support arms may be circumferentially spaced apart from one another at the radially inward edge of the chain engaging portion and may merge with the circumferentially adjacent support arms at the radially outward edge of the mounting portion.